ENGINEERING SOILS MAP OF PERRY COUNTY, INDIANA

MAY, 1968
NO. 7

by

P.T. YEH

Joint Highway Research Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

Final Report

ENGINEERING SOILS MAP OF PERRY COUNTY, INDIANA

TO: Dr. G. A. Leonards, Director
Joint Highway Research Project

May 9, 1968

File: 1-5-28-45

Project: C-36-51B

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

The attached report, entitled "Engineering Soils Map of Perry County, Indiana," complete a portion of the project concerned with development of county engineering soils map of the State of Indiana. This is the 45th report in the series. The report was prepared by F. T. Yeh, Research Engineer, Joint Highway Research Project.

The soil mapping of Perry County was performed primarily by using annotated aerial photographs produced as field surveys by the Soil Conservation Service. Several soil profiles were samples by the Soil Conservation Service and soil tests were performed by the Soil Testing Laboratory of the Joint Highway Research Project. Engineering test data on various soil horizons are included in the report and generalized soil profiles of the major soil groups are presented on the Soils Map. An ozalid print of the engineering soils map is included in the report.

Respectively submitted,

Harold L. Michael

Harold L. Michael
Associate Director

HLM:sb

Attachment

Copy: F. L. Ashbaucher
W. L. Dolch
W. H. Goetz
W. L. Gracco
G. K. Hallock
M. E. Harr
R. H. Harrell
V. E. Harvey
J. A. Havers
J. F. McLaughlin
F. B. Mendenhall
R. D. Miles
J. C. Oppenlander
G. F. Scholer
M. B. Scott
W. T. Spencer
H. R. J. Walsh
K. B. Woods
E. J. Yoder

Final Report

ENGINEERING SOILS MAP OF PERRY COUNTY, INDIANA

by

P. T. Yeh
Research Engineer

Joint Highway Research Project

Project No: C-36-51B
File No: 1-5-28-45

Prepared as Part of an Investigation

Conducted by

Joint Highway Research Project
Engineering Experiment Station
Purdue University

in cooperation with the

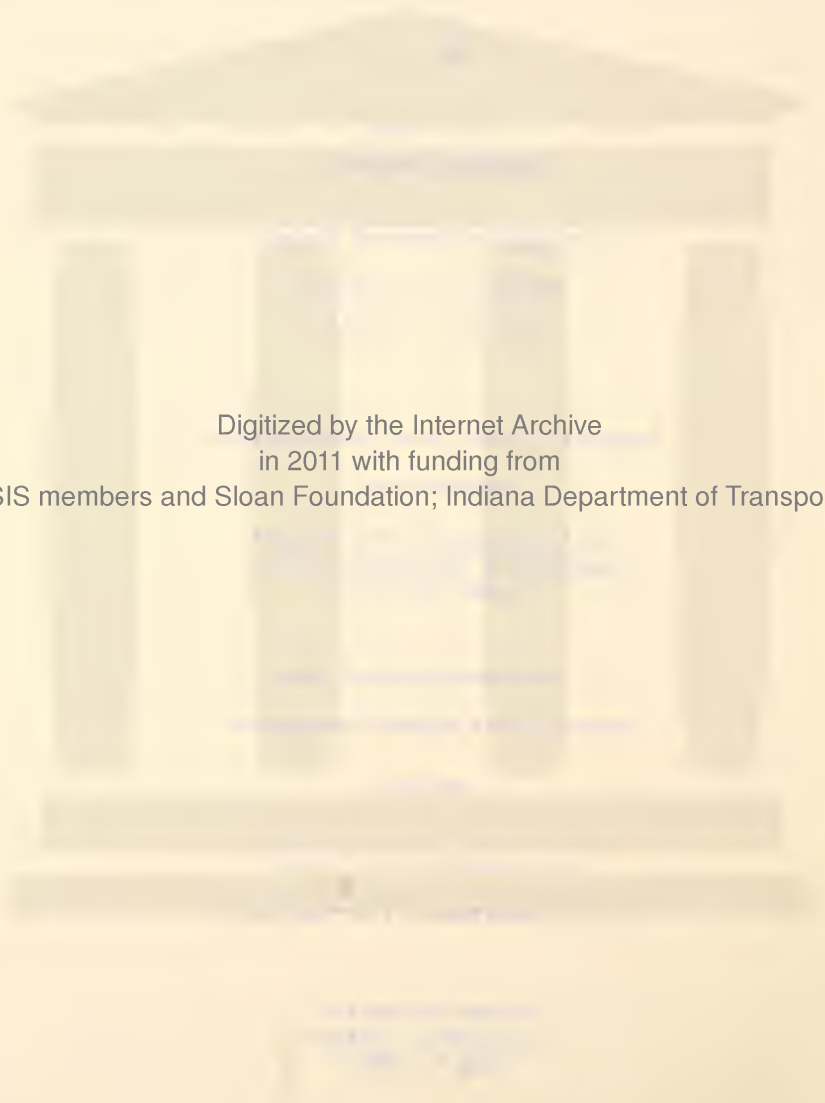
Indiana State Highway Commission

and the

Soil Conservation Service

U. S. Department of Agriculture

Purdue University
Lafayette, Indiana
May 9, 1968



ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance given by all those persons who have helped in the preparation of this report. Special acknowledgements are due the members of the Advisory Board, Joint Highway Research Project, for their active interest in furthering the study; Professor H. L. Micheal, Associate Director, Joint Highway Research Project, for review of the report; Professor R. D. Miles, in charge of the Airphoto Interpretation and Photogrammetry Laboratory for his review and suggestions; Soil Conservation Service for their efforts in sample collections; Professor E. J. Yoder, in charge of the Soil Testing Laboratory, for his efforts in supervising the soil testing; Mr. T. C. Bass, State Soil Scientist, of the Soil Conservation Service, for his efforts in clearifying the soil series and Mr. Y. K. Tang, graduate assistant, for drafting the final engineering soils map and preparing the illustration.

ENGINEERING SOILS MAP OF PERRY COUNTY, INDIANA

by

P. T. YEH

INTRODUCTION

Development of an engineering soils map of Perry County was the primary objective of this study. The purpose of the report is to supplement the information appearing on the engineering soils map attached.

The engineering soils map was prepared primarily from pedological soil data. The pedological soil data consisted mainly of annotated aerial photographs which were marked in great detail during the field soil survey of Perry County by the Soil Conservation Service and Purdue University Agricultrual Experiment Station.

The aerial photographs used to delineate boundaries for the engineering soils map were 10 x 12 inch enlargements from the 7 x 9 inch negatives taken in July 1940. The approximate scale was four inches to one mile or 1:15,840.

Numerical symbols on the annotated photographs indicated soil texture, soil catena, drainage profile, slope class and erosional class according to USDA classification systems. The soil series is recognized by the catena number and the accompanying drainage profile number. Grouping of soil series into appropriate landforms and parent materials was the primary technique used in this engineering soil mapping study. The landform and parent material boundaries were then delineated on the photographs. After the soil boundaries were transferred to the base map

(scale: one inch equal one mile) routine airphoto interpretation techniques were used to check and modify the engineering soil boundaries.

Soil sampling was performend by the USDA soil scientists. Twenty-nine samples of soils taken from ten profiles were tested by the Joint Highway Research Project, Civil Engineering School, Purdue University. Grain size analysis, Atterburg limits and the standard Proctor compaction characteristics were determined (Appendix A). The soils were classified according to the American Association of State Highway Officials and the Unified Soil Classification System.

Additional soil test data are included in Appendix B. These data were taken from the consultants report to the Indiana State Highway Commission on I-64 in Perry County.

The engineering soils map was prepared with graphic symbols to delineate parent materials (grouped according to landform and origin). Textural symbols were superimposed on the parent material symbols to indicate relative composition of the parent material soils. The map also illustrates soil profiles showing the general soil profile of each parent material area.

DESCRIPTION OF AREA

General

Perry County is located in the southern central part of Indiana on the Indiana - Kentucky State line (Fig. 1). Perry County is very irregular in shape. The county borders over two thirds of the distance following the meandering courses of the Ohio River and the Anderson River. Perry County has a maximum length of 29 miles (north-south) and a maximum width

FIG. 1 LOCATION MAP OF PERRY COUNTY

(east-west) of 20 miles. The county area is approximately 384 square miles (1).*

The total county population in 1960 was 17,327 (2). Cannelton, the county seat, located along the Ohio River at the southwestern corner of the county had 1,829 inhabitants. About three miles northwest from the county seat is Tell City. The population of Tell City was 6,609 in 1960. Other small communities are scattered mainly along the Ohio River.

Perry County is chiefly a wooded country as shown in Fig. 2. There were 79,131 acres of farm land in Perry County which is about 32 percent of the county area according to the 1959 census of agriculture (3).

Drainage Features

Perry County lies wholly within the drainage basin of the Ohio River. Anderson River with its tributaries such as Middle Fork, Sulphur Fork, Theis Creek, Kraus Creek and Brushy Fork drain the northwestern half of the county (Fig. 3). The rest of the county is drained by south flowing streams. They are Deer Creek, Poison Creek, and Oil Creek.

The predominant drainage patterns of Perry County are the sub-deadritic pattern characterstic of residual bedrock area of southwestern Indiana (4). The western half of the county has a higher gully density than the eastern half. A few sinkholes have developed near the southeastern corner of the county. The courses of streams reveal many incidents of rock control. The colinear drainage patterns are presented along the Ohio River bottom lands. The characteristic rectilinear pattern of lacustrine areas is obliterated by the narrowness of the lakebeds.

---

*Figures in parentheses refer to references appearing in the bibliography.

FIG. 2 AIRPHOTO MOSIC OF PERRY COUNTY

FROM 1940 INDEX MAP

FIG 3

DRAINAGE MAP

PERRY COUNTY

INDIANA

PREPARED FROM

1940 AAA AERIAL PHOTOGRAPHS

BY

JOINT HIGHWAY RESEARCH PROJECT

AT

PURDUE UNIVERSITY

1951

SCALE OF MILES

PREPARED UNDER THE SUPERVISION OF MYRLE FAHIS

POLYCONIC PROJECTION

Climate

The Climate of Perry County is continental, humid and temperate. The warm humid summers and moderately cold winters are characterized by frequent sudden changes of temperature. The wide variations occuring within a season can be seen from the minimum and maximum temperature listed on Table I. (5). The mean precipitation at Rome (35 year record) is about 46 inches while at Tell City (29 years of record) is about 44 inches (6). The driest and wettest year records are listed in Table I also.

Physiography

Perry County lies wholly within the Crawford Upland physiographic region of Indiana (Fig. 4). With respect to its physiographic situation in the United States, the county is a part of the Highland Rim Plateau Section of the Central Lowland Province (7).

Topography

Perry County is the roughest county in Indiana (Fig. 5). The picturesque scenery is due both to the diversity of rocks and the nearness to the deep gorge of the Ohio River. Perpendicular rock walls, solution cavities, deep wooded ravines are the common landscape of this county. The only level country is found on the stream bottoms, stream terraces and lacustrine plains.

The highest point in Perry County is about 875 feet located about one-half mile north of the Ohio River just west of the boundary of Crawford County. The maximum local relief is 511 feet, measured from the ridge top to the Ohio River normal pool. A local relief difference of 402 feet is found on the ridge along the Ohio River about four and one-half

TABLE I

NORMAL MONTHLY TEMPERATURE AND PRECIPITATION

AT TELL CITY, PERRY COUNTY INDIANA

(Elevation 394 feet)

h	Temperature			Precipitation		
	*Average (1966) °F	Maximum °F	Minimum °F	**Average (1966) Inches	Driest Year (1953) Inches	Wettest Year (1950) Inches
ary	28.1	79	-13	2.55	4.63	13.79
uary	34.0	77	-8	4.30	1.16	6.35
h	46.4	88	2	1.66	4.96	4.07
l	52.4	91	26	8.26	4.83	4.82
	61.3	96	31	4.14	4.41	6.93
	72.2	102	20	1.90	0.24	3.42
	80.3	105	52	2.08	1.62	3.59
st	73.9	104	48	3.49	0.87	10.75
ember	67.2	106	31	2.86	0.46	11.02
ber	53.4	96	21	2.30	1.17	0.77
mber	48.0	86	0	3.80	1.68	5.71
mber	36.2	72	-12	5.48	2.80	2.63
	54.5	106	-13	45.82	28.83	73.85

*Because of the relatively short records (from March 1939 to Dec. 1967) no mean temperature given in the climatological data therefore the year 1966 is used as an example.

**Since the precipitation record in Tell City started, September 1939 no long term mean precipitation is published in the Climatological data, the 1966 record is used as an illustration.

Rome has 34 years of temperature and precipitation records. The station was closed after the establishment of the Tell City station.

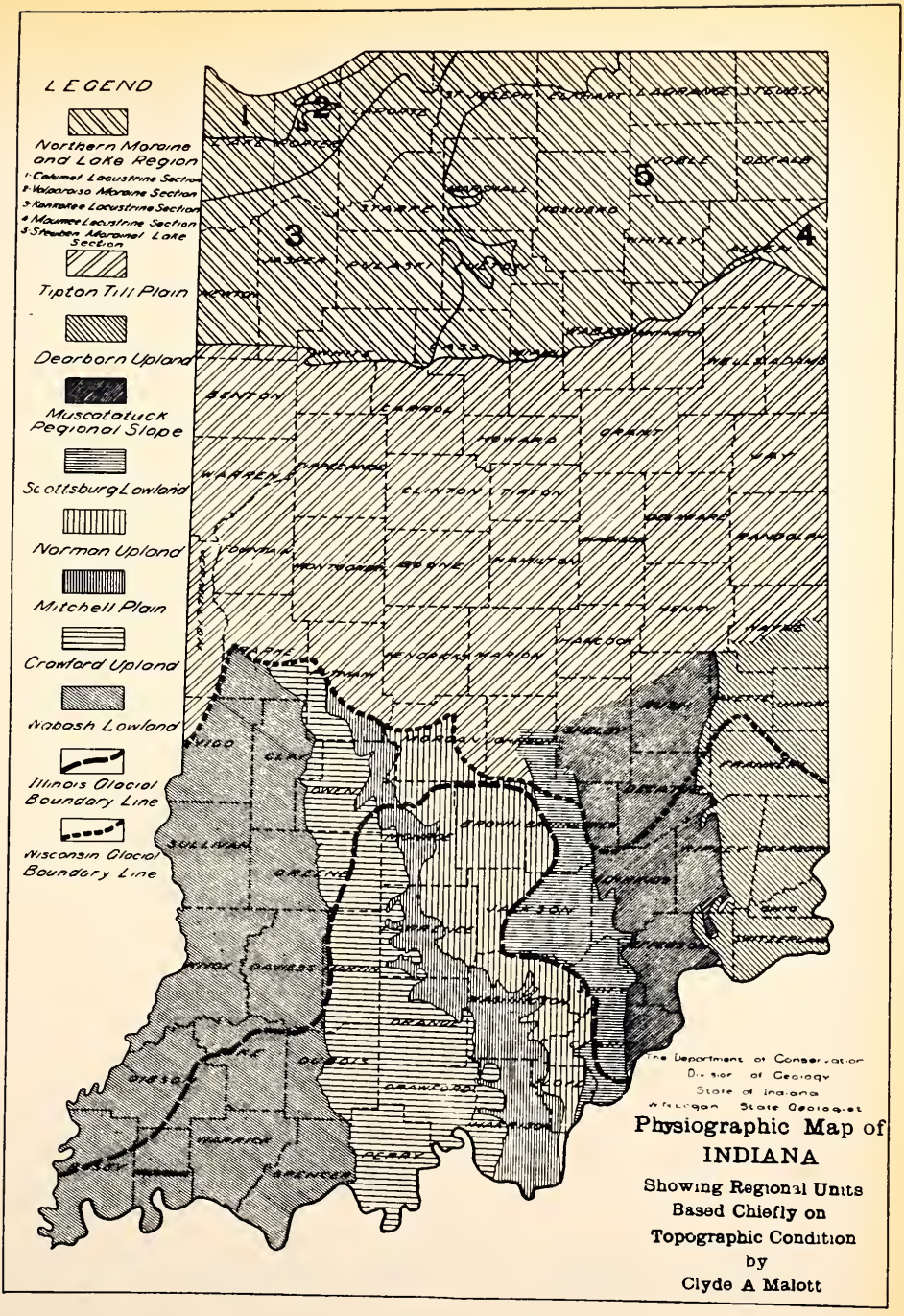

LEGEND
Northern Moraine and Lake Region
1. Calumet Lacustrine Section
2. Valparaiso Moraine Section
3. Kankakee Lacustrine Section
4. Maumee Lacustrine Section
5. Steuben Morainal Lake Section
Tipton Till Plain
Deerborn Upland
Muscatatuck Regional Slope
Scottsburg Lowland
Norman Upland
Mitchell Plain
Crawford Upland
Wabash Lowland
Illinois Glacial Boundary Line
Wisconsin Glacial Boundary Line
The Department of Conservation
Division of Geology
State of Indiana
W. N. Logan State Geologist
Physiographic Map of INDIANA
Showing Regional Units
Based Chiefly on
Topographic Condition
by
Clyde A Malott

FIG. 4

DERIVED FROM THE VINCENNES (NJ 16-5) AND EVANSVILLE (NJ 16-8) NATIONAL TOPOGRAPHIC 1° QUADRANGLES

SCALE 1 / 250,000

FIG. 5 TOPOGRAPHIC MAP OF PERRY COUNTY

(CONTOUR INTERVAL 100')

miles southwest of Rome. Most of the hills or ridges in Perry County rise from 200 to 300 feet above the valleys. The lowest point of Perry County is about 358 feet above sea level at the point where the Anderson River joins the Ohio River. The elevation of 358 feet is the normal pool elevation of the Ohio River at this point.

Geology

The bedrock formations of Perry County consists of strata of Mississippian and Pennsylvanian age. The Mississippian strata outcrop in the eastern part of the county and the Pennsylvanian strata in the western part. Quarternary deposits in the county consist of clays, silts, sands and gravels of the Pleistocene and Recent Ages (8).

The Mississippian strata exposed in Perry County consists of the lower, middle, and the upper Chester groups. The lower Chester group occurs in the extreme eastern part (T.5 S.,R.1 E. and R.1 W.). The Middle Chester group lies in the eastern third of the county and the south central area along the Ohio River. The Upper Chester group is found mostly in the eastern half of the county and in the valleys of the western part of the county. The Pennsylvanian strata occupy the western half of Perry County and all the ridges and hill tops in the central part of the county (9).

The surface rocks of the western half of Perry County are about equally divided between the Coal Measures and Mansfield sandstone (10). The massive medium grained Mansfield sandstone is the ridge former. Along Deer Creek and to the east the Mansfield sandstone is full of quartz pebbles. The conglomerate character occurs throughout the greater part of the high ridges running north and south through sections 8, 10, 15, 22 and 27 in T.7 S.,R.2 W. (11). In places the conglomerate is 25 feet or more in thickness (11).

The Coal Measures in Perry County consist of a very thin (an inch or so in thickness) Coal I, about a foot of Coal Ia, three to five feet thick of Coal II, one to two feet layer of Coal IIa and about two feet stratum of Coal III (11). The mining areas are shown by the strip mine symbol on the western part of the county.

Outcrops of limestone of the Mississippian age occur on the eastern part of the county in sections 9, 16 and 17, T.7 S.,R.2 W. and in section 2 and 11 T.4 S.,R.1. W. and many places between these two points in either the stream beds or the bluffs of almost all intervening tributeries. Other outcrops are found in the bluffs of Deer Creek in section 6 T.7 S.,R.2 W. and section 31 T.6 S.,R.2 W. (10). A 15-foot ledge of limestone outcrops in section 19 T.4 S.,R.2 W. (11). A few limestone quarries are indicated on the map.

The quarternary deposits consists of eolian and fluvial materials. In much of the hill tops or ridges a layer of loess overlies the residual soils and rocks. The loess cover varies from zero to about 36 inches on the upland. Along the Ohio River, however, thicker loess deposits are observed. A limited area of sand dune deposits are found along the Ohio River.

Low river and stream terraces occur along the Ohio and Anderson Rivers and their major tributaries. Many lakebed or lacustrine deposits are also associated with the major drainage courses. Alluvial plains are found on the bottom lands of all valleys.

LANDFORMS AND ENGINEERING SOIL AREAS

Engineering soils in Perry County are derived chiefly from the weathering of sandstone, shale and limestone bedrocks. However, a great portion of the residual soils are covered by a thin (up to 36 inches)

mantle of loess. Thicker loess deposits are found along the Ohio River. A number of windblown sand deposits in the form of dunes are recognized on the terraces. Fluvial deposits in the forms of river terraces, lacustrine plains and alluvial plains occupy the low topographic positions of Perry County.

Residual Soils

Residual soils occupy about 80 per cent of the county area. These residual soils are covered by a thin blanket of loess except along the steep slopes where fluival erosion may have removed the loess. The residual soil area is subdivided into two groups: namely the thin loess covered residual soil and the residual soil. The residual soils were derived from two types of formations. The major one is the sandstones-shale formation and the minor one is the limestone bedrock.

1. Loess Covered Sandstone-Shale Plateau

About half of the sandstone-shale residual soil area is covered by a thin layer of windblown loess. This soil occupies the ridge top or crest positions where the slope is gentle (from 2 to 18% slope) and erosion is slight. The boundary of this soil is very irregular and the width of the area is generally very narrow particularly in the western half of Perry County. The ridge tops become broader in the northeastern portion of the county. The topography of this soil region varies from undulating to gently rolling. The region is being farmed.

The soils developed in this area are silt (18 to 36 inches in thickness) underlain by interbedded sandstone and shale. The variation of the depth of the soil profile is due mainly to its topographic position. On the steeper slopes, the silt or the loess cap is thinner because of erosion.

Bedrock is usually reached at a depth of three to five feet from the surface.

The surface soil varies from a silt loam to silty clay loam of the A-4 or ML classification (AASHO and Unified Classification respectively). Test samples taken from sites Nos. 8, 9 and 10 showed that the sand content is less than 10% while silt constituted 64 to 75% and clay varied from 26 to 21%. The B-horizon ranges from a silty clay loam texture to a silty clay soil which is classified as A-6 to A-7 or as ML-CL or CL soil. The test samples indicated that the amount of silt decreases to 55-58% while the quantity of clay increases to 36-38%. A layer of stony silty clay loam or stony clay is found above the rock. The texture varies according to the immediate underlying bedrock material. This layer will be more sandy less clayey and mixed with more sandstone fragments if the bedrock is sandstone. Site No. 10 revealed 20% sand, 54% silt and 26% clay and the soil is classified as A-4 or CL soil. At site No. 8 the immediate layer above the clay shale bedrock consists of 7% sand, 53% silt and 49% clay and is classified as clay, A-7-6 or CL soil.

Soil profile survey by the consultants (12, 13, 14) varified the condition from the deep profiles. The clayey soil (A-6 to A-7-6) developed immediately above shale bedrock is revealed at test sites No. 19, 21, and 24. From these reports the top stratum varies from silt loam to silty clay loam or silty clay A-4 to A-6. In boring sites Nos. 21, 44 and 46 a clayey soil (A-7-6) is found just beneath the top soil.

2. Sandstone-Shale Plateau

The other half of the sandstone shale region exhibits a soil that

is residual derived from the bedrock strata. The author regarded this region as residual sandstone-shale and limestone soil in his previous engineering soils of Interstate I-64 between Scalesville and New Albany (15). He did point out that the soils represented in the region are almost completely developed on sandstone-shale, Therefore in this report this region is considered as sandstone-shale soil area. These soil areas occupy mainly the steep slope (over 18%) areas along the valley walls. The loess deposit over this region has been removed by erosion.

The topography of this region is extremely rugged. Farming activity is impossible because of the steep slopes. The region is left entirely to timber. The Ferdinand State Forest and The Hoosier National Forest occupy a great portion of this region in Perry County.

The variation of the soil texture and profile depends on the immediate bedrock and the topographic position. The surface soils on the very steep slopes may have been removed entirely by erosion. The A-horizon if present, varies from a stony, sandy loam to a silty clay loam (A-4 or ML soil). The sample taken at site No. 7 illustrates 2% gravel, 4% sand, 75% silt and 19% clay in the A-horizon. The B-horizon contains considerable more clay and more stony fragments and ranges from a stony silt loam to a stony silty clay (A-6 or ML). The soil data of site No. 7 shows that the gravel in the B-horizon increases to more than 60%, It is classified as an A-6 or ML soil. The interbedded sandstone-shale bedrock is found less that one foot from the surface in places.

From the soil profile survey by the consultants (12, 13, 14) the top stratum is generally a loam or a silt loam (A-4) as illustrated in boring sites Nos. 12, 18, 32, 34, 35 and 36. However, a sandy loam (A-2-4 to A-4)

upper solum is found in sites No. 11 and No. 40. In places (such as site No. 11 and No. 31) sandstone bedrock occurs directly beneath the sandy loam strata. The boring record of the consultants reports (12, 13, 14) shows no limestone encountered in the western quarter of the county. Thin layers of limestone, however, occur in a few places. A 1.8 foot limestone layer is found 42 feet below the surface just east of test site No. 24. A layer of hard limestone (4.5 foot) with clay seams is found 14 feet below the ground surface between test site No. 31 and No. 32. A thick layer (10 foot) of limestone that lies 13 feet below the ground surface is located near site No. 40. Thick limestone strata are encountered at the hole located just 400 feet east of test site No. 44. A 5.5 foot layer is encountered 10.5 feet from the surfac and another 9 feet or more occurs 5 feet below the layer just mentioned. All those data confirm that the limestone is thicker and closer to the surface in the eastern part of Perry County.

3. Loess Covered Limestone Bench

About three square miles of area in Perry County is classified as thin loess covered limestone soil region. This soil region is scattered in the southeastern section of the county. The main body lies near the foot of the valley walls along Poison Creek and Bear Creek north of Hardingrove. Others are scattered near the mouth of Oil Creek and the upper end of the Little Oil Creek. Some small areas are located east and south from Dodd.

Topographically speaking the soil area has a bench-like terrain situated about 50 feet above the alluvial plain. The surface is gently rolling with sink-hole topography in some areas such as in section

13 T.5 S., R.1 W., section 13 T.6 S., R.2 W. and section 18 T.6 S., R.1 W. (Fig. 3). The surface slope in this region is less than 18% therefore farming is possible.

The soil of this region is derived from two different materials. The upper solum of the soil profile is developed in a 24 to 42 inch blanket of wind blown loess. The lower solum is the residum from limestone. The soil profile consists of a silt loam (A-4 or ML) top soil a silty clay loam (A-6, or CL) subsurface soil which is derived from loess. The subsoil that is derived from the limestone is clayey (A-7 or CH) in texture. The limestone bedrock is found from about five to ten feet below the ground surface. A large limestone quarry is located in this region near Derby.

4. Limestone Bench

Areas classified as limestone residual soil are very limited in Perry County. They are associated closely with the loess covered limestone region. These soil areas occupy the steep slopes (from 18% to 70%) in the limestone region. The loess cover has been removed completely by rain water. The area is not suitable for farming.

The soil solum is thin and contains many limestone fragments. The top soil varies from a stony silt loam to a stony silty clay loam (A-4 or ML). The subsoil is stony plastic silty clay or clay (ranging from A-6 or A-7 or CL to CH soil). The limestone bedrock occurs from less than one foot to about three feet below the ground surface.

Water Deposited Materials

Extensive areas of water deposited material exist in Perry County. Three different types of landforms have been created by the action of

water, namely: terrace, lacustrine plain and alluvial plain.

1. Terraces

Two type of terraces occur in Perry County. They are the granular terrace and the slack water terrace.

(a) Granualr Terraces

The granular terraces are confined to the Ohio River terraces. The terraces along the Ohio River are rather broad, in places about one mile wide. The largest terrace lies near Tobinsport at the southern tip of the county.

The altitudes at the terraces vary from 420 feet to about 400 feet above sea level or about 50 feet above the normal pool elevation of the Ohio River. The surface of the terrace deposit is very flat and slopes very gently from the foot of the valley wall toward the river. The surface of the terrace is only slightly higher than the adjoining flood plain and is devoid of surface drainage. Infiltration basins are also absent on the terraces in Perry County. Only occasional current scars may be observed. Due to the favorable topographic condition, the terraces in this county are extensively farmed. Many important cities or communities such as Tell City, Cannelton, Troy, Tobinsport and Rome are built on the terraces. The terrace is easily delineated by its uniformly light tonality, bench like topographic position and the current scars exhibited on the airphotos.

The soils of the Ohio River terraces vary horizonally as well as vertically. The surface soil ranges from a sandy loam to a silty clay loam, generally classified as A-4 or ML soil Samples taken from sites No. 1, 2 and 3 illustrate the texture variation. At site No. 1 the

surface soil contains 5% sand, 70% silt and 25% clay (A-7-6 or ML-CL soil). Sample taken at site No. 2 is composed of 50% sand, 37% silt and 12% clay (A-4 or SM soil). A silt loam (A-4 or ML-CL) soil with 18% sand, 64% silt and 16% clay is found at site No. 3. The B-horizon is more clayey in texture than the surface soil. The texture varies from sandy loam to silty clay (A-4 to A-6 or SM or CL soil). Only a limited amount of gravel is found on the Ohio River terraces. The majority of the deposits are sand and silt. However, gravel stratum may be found at depth.

(b) Fine Textured Terraces

Many deposits along the major tributaries of Anderson River and the Ohio River are considereed as fine textured terraces. The larger deposit in Perry County lies along Anderson River northeast of Adyeville. Others are on both banks of the Middle Fork Anderson River, Sulphur Fork, Kraus Creek, and Little Deer Creek and scattered along Poison Creek, Oil Creek and Little Oil Creek. The fine texture terraces are slack water terraces. Topographically they are flat and only slightly higher (about 10 feet) than their adjacent alluvial plain. Infiltration basins are absent in these areas. However, current scars can be observed on the airphotos. Surface drainage is not well developed. The current scars serve as drainage channels in this region. The topography in this area is favorable for farming. However, the shapes of the farms are much more irregular than those on the Ohio River terraces.

The soil in this region is more unform in the upper solum. The surface soil is a silt loam texture and is classified as A-4 or ML-CL soil. Samples taken from sites 4 and 5 reveals that the silt content is from 60 to 71% and the amount of sand from 21% to 10%. In the B-horizon

the clay content increases somewhat and the soil became silty clay loam in texture (A-6 to A-4 or CL soil). The lower portion of the B-horizon shows variation of texture. It ranges from silty clay loam, clay loam to a silty clay. Stratified silty clay loam and silt loam is found in the parent material at a depth about three feet below the ground surface. For a deeper profile the reader may refer to the consultants report (12, 13, 14). Sites 14, 17, 25, 26, 27 and 28 from the ISHC boring show the profile variation. Sand strata are encountered at site 14, 17 and 28 which varies from 7 feet to 42 feet below the surface. Sandstone bedrock was encountered at a depth of 30 to 35 feet at site No. 26 and 28 respectively. Shale bedrock is reached at a depth of 48 feet at site No. 27.

The most complicated profile is at site No. 25. The texture changes about every two feet. Immediately below the top soil lies a A-7-6 clay than followed by a A-4 sandy loam and A-2-6 sandy loam. At the depth of six feet a clay loam (A-4) strata is encountered followed by sandy loam (A-2-6), and a six foot strata of silty clay loam (A-7-6). A clay soil (A-7-5) is reached at a depth of 18 feet. This variation is certainly a local effect.

The rest of the borings show the majority of the terrace materials are loam and clay loam which falls in the A-4 soil classification.

2. Lacustrine Plain.

The lower reaches of the tributaries of the Ohio River contain lacustrine plains. The largest deposit is along Little Oil Creek at Dexter where the lacustrine plan is more than one mile wide. Another large deposit is located at the confluence of the Middle Fork Anderson

River and the Anderson River. Deer Creek also has a large lacustrine plain.

The surface of the lacustrine plain is extremely flat. However, the lands adjoining to the major drainage channels is subjected to severe erosion and undulating or rugged topography results. Surface drainage is fairly well developed in this deposit particularly at the areas close to the drainage channels.

The surface elevation of the largest lacustrine plain at Dexter is about 430 feet above sea level which is slightly lower than the adjoining Ohio River terrace to the South. The lacustrine plain near the mouth of the Anderson River has an elevation about 415 feet. The low topographic position, the smoothness of the surface and the uniform medium grey tone of this deposit made it easy to delineate on the airphotos.

Since the lacustrine plain was formed by a temporary lake dammed by glacial melt water, the texture of the deposit is relatively fine. Clayey and silty materials are the major textures occuring in this deposit. The surface soil varies from a silt loam to a silty clay loam (ML-CL or A-4(b A-6 soil). The B-horizon is a highly plastic clay which contains 30 to 40% silt and 50 to 60% clay and is classified as CH or A-7 soil. The parent material has about the same composition but is slightly less plastic than the B-horizon and generally is classified as silty clay or clay (CL or A-7 soil).

3. Alluvial plain

Two types of alluvial plains are recognized in Perry County. One is granular in texture the other is a fine textured deposit.

(a) Granular Textured Alluvial Plains

Only a few narrow strips along the Ohio River in Perry County are classified as granular textured alluvial plains. The longest alluvial plain is about three miles in length and extends from Cannelton to Tell City. The other one lies South of Dexter. Short strips are found southwest of Tobinsport and Hardingrove.

The surface of this granular alluvial deposit is more rolling than the smooth flood plain especially the one located southwest of Tobinsport. The speckle photo tone is an indicator of its granular texture. The deposit is not much different in elevation than the adjoining flood plain.

The surface soil is chiefly a fine sandy loam (SM or A-2 soil). The subsurface soil has a loamy sand texture classified as SM or A-2 soil. Stratified fine sandy loam, loam, fine sand and sand is reached at a depth about three feet from the surface. Further down gravel may be found mingled with a large amount of fine sand.

Taylor reported that on the bluffs of the Ohio River above Cannelton and Tell City are some very fair gravel deposits (10). The gravel deposit is found beneath 11 feet of stripping and has a depth of more than 15 feet. The deposit consists of 2% boulder, 21% gravel, 25% pebble, 7% sand and 45% fines (10). About 75% of this gravel is chert (10).

(b) Fine Textured Alluvial Plain

All the streams and rivers in Perry County possess flood plains which can be classified as fine-texture alluvial deposits. Most of the alluvial plains are narrow except those along the Ohio River. The widest one is located near Dexter.

Most of the alluvial plains have flat to nearly level surfaces. Natural levees are developed along a portion of the larger streams.

Special features such as current markings and meandering stream channels can be seen on the airphotos. The alluvial plains occupy the lowest topographic position in the county. The light tonality and the drastic topographic break from the upland made the delineation of this plain very easy.

The texture of this alluvial deposit varies greatly both horizonally and vertically from one place to the other. Coarser textured deposits such as sandy material are found closer to the drainage channel especially on the natural levees. Finer textured material occur toward the edge of the foot hills. The top soil of this alluvial deposit may be sandy loam, loam, silt loam or silty clay loam. The subsoil varies from sandy loam to a silty clay loam. Stratified sand, sandy loam, silt and clay are found in the lower strata.

The profile variation can be observed from the soil profiles at sites No. 15, 16, 23, 29 and 30. The top stratum of most of the profile is a silt loam A-4 soil. However, at site No. 16 just a short distance from site 15 on the other side of Hurricane Creek a thick (12 ft.) sand (A-2-4) stratum is found. At site No. 29 on the flood plain of Anderson River near Kitterman Corners, the upper two feet of the soil profile is a silty clay loam (A-4 soil) which overlies three feet of sand and then eight feet of sandy loam (A-4). Clay, silty clay and silty clay loam are the common substrata in this region. Sand strata are found in every profile at various depths from the surface.

Eolian Deposits

Extensive eolian deposits occur in Perry County. They are subdivided into three groups namely, thin loess covered plateaus loess plains and sand dune deposits.

1. Thin loess covered residual soil

Nearly half of Perry County is covered by a thin blanket of loess (18 to 36 inches). Only the top part of the soil profile is subject to the loess influence. Therefore the discussion of this loess mantle is not treated separately but included with the other landforms and has been discussed previously as loess covered sandstone-shale plateaus and loess covered limestone plateaus.

2. Loess Plains

Along the Ohio River a number of places are recognized as thick loess (10 to 30 feet in thickness) deposits. The largest deposit lies east of Tell City. Another is located east of Troy. Smaller ones are scattered along the Ohio River valley.

The loess has been derived from the adjacent terraces and flood plains to the west. Those located east of Cannelton occur on the ridge tops. The topography of this region is influenced greatly by the eroded sandstone-shale bedrock before the deposition took place. The thick blanket, however, has smoothed the rugged landscape somewhat and reduced the slope of the land. Because drainage is controlled by the underlying bedrock, the typical loess drainage pattern (pinnate) does not occur.

The soil solum is developed entirely from windblown silt and the soil profile is more uniform that those of the other areas discussed. The surface soil is a silt loam A-4 soil (ML or CL). In the low area a small amount of organic matter is present in the top soil. The B-horizon has a silty clay loam texture (CL or A-7 soil). The parent material is a silt loam or silt classified as ML-CL or A-4 or A-6 soil.

3. Sand Dunes

Only limited areas in Perry County are recognized as sand dune deposits. The longest stretch (about 2.5 miles) lies between Dodd and Tobinsport. The next large one occurs at Dexter. Others are located near Troy and east of Cannelton.

The sand dune deposits in Perry County are presented in many forms. The sand dune between Dodd and Tobinsport has a ridge-like shape. The crest reaches an elevation of 460 feet which is about 40 feet higher than the Ohio River terrace. Elongated sand ridges are found near Dexter. The dune east of Cannelton is deposited on the foot of the sandstone-shale hill. It lacks the typical sand dune shape. Those at Troy are inconspicuous also. They rise about 10 to 20 feet from the adjacent plains and exhibit no well defined forms. However, the speckle-like infiltration basins in the sand deposit give a strong indication of the material.

The soil is derived from windblown fine sand and silt. The top soil is a fine sandy loam (ML-SM or A-4). It contains little more clay in the B-horizon and has a sandy clay loam or loam and then silty clay loam (CL or A-6) texture. Before reaching the fine sand parent material, a layer of fine sandy loam (SM or A-4) occurs. The parent material is classified as fine sand (SM-SP or A-3 soil).

Test site No. 6 reveals that the top soil contains 50% sand, 40% silt and 10% clay and is classified as non plastic SM or A-4 soil. The B-horizon taken at a depth of 20-40 inches shows that the sand has decreased to 22% and the amount of clay increases to 30%. The texture of this layer is clay loam, (CL or A-6). Sample take a depth of 74 to 86 inch consists of 88% sand, 3% silt and 9% clay and is classified as a SP-SM or A-2-4 soil.

1. "Atlas of County Drainage Maps, Indiana" Airphoto Laboratory, Joint Highway Research Project, Engineering Experiment Station, Purdue University and State Highway Department of Indiana. Engineering Bulletin. Extension series No. 97 July, 1959.

2. "United States Census of Population, 1960 ," U. S. Bureau of Census, United States Bureau of Commerce, Government Printing Office Washington D. C., 1963.

3. "United States Census of Agriculture 1959," Vol. 1 Part II, Bureau of Census, United States Department of Commerce, Government Printing Office, Washington D. C., 1961.

4. Parvis, M., "Regional Drainage Patterns of Indiana," Unpublished thesis in partial fulfillment of the Degree of Civil Engineer, Purdue University, Lafayette, Indiana, 1947.

5. "Climatological Data of Indiana," Weather Bureau, United States Department of Commerce, Government Printing Office, Washington, D. C.

6. "Climate and Man" Year Book of Agriculture, United States Department of Agriculture, Washington D. C., Government Printing Office, 1941.

7. Logan, W. H., "Handbook of Indiana Geology," Indiana Department of Conservation, State of Indiana, Indianapolis, Indiana, 1922.

8. Logan, W. H., "The Sub-surface Strata of Indiana," Publication No. 108, The Department of Conservation Indianapolis, Indiana, 1931.

9. "Geologic Map of Indiana" Atlas of Mineral Resources of Indiana, Map No. 9, Geological Survey, Department of Conservation, State of Indiana, 1956.

10. Taylor, A. E., "The Roads and Road Materials of Portion of Southwestern Indiana," 30th Annual Report, Indiana Department of Geology and Natural Resources, 1905, Indianapolis, 1906.

11. "Detailed Geology of Indiana Coal-Perry County," 23rd Annual Report, Indiana, Department of Geology and Natural Resources, 1898, Indianapolis, Indiana, 1899.

12. Soil Profile Survey for Interstate Project No. I-64-2(5) 73, Perry County, Indiana, Stations 1495+70, prepared for Engineer Associates, Inc., Evansville, Indiana, by American Testing and Engineering Corporation, Indianapolis, Indiana.

13. Soil Profile Survey for Interstate Project No. I-64-2 (4) 57 P. E. Perry County Indiana, Stations 1666+70 to 1848+50, prepared for Engineer Associates, Inc., Evansville, Indiana, by American Testing and Engineering Corporation, Indianapolis, Indiana.

14. Soil Profile Survey for Interstate Project, No. I-64-2 (5) 73 P. E. Perry County, Indiana, Stations 1848+49.78 to 2112+03.38, prepared for Reid, Quebe, Thompson and Associates, Inc., by American Testing and Engineering Corporation, Indianapolis, Indiana.

15. Yeh, P. T., "Airphoto Interpretation of Engineering Soils of Interstate Highway Route 64 between Scalesville and New Albany in Warrick, Spencer Dubois, Perry, Crawford, Harrison, and Floyd Counties, Indiana" Report No. 24, Joint Highway Research Project, Engineering Experiment Station, Purdue University, In cooperation with Indiana State Highway Commission, Bureau of Public Roads, and the Soil Conservation Service, September, 1965.

Site No.	Horizon	Depth in Inches	Unified Classification A)	AASHO Classification
1	A_p	0-9	ML-CL	A-7-6 (10)
	B_{21}	16-32	CL	A-6 (10)
	C	50-60+	CL	A-6 (9)
2	A_p	0-9	SM	A-4 (3)
	B_2	21-36	SM	A-4 (3)
	C_1	60-72	SM	A-4 (1)
3	A_p	0-9	ML-CL	A-4 (8)
	B_{22x}	26-46	ML-CL	A-4 (8)
	C_1	60-75	CL	A-6 (11)
4	A_p	0-8	ML-CL	A-4 (8)
	B_{21}	15-28	CL	A-6 (9)
	C	50-60+	ML-CL	A-4 (4)
5	A_p	0-8	ML	A-4 (8)
	B_1	18-32	CL	A-4 (8)
	B_{21x}	32-50	ML-CL	A-6 (8)
	C_2	74-82+	ML-CL	A-6 (8)
6	A_p	0-10	SM	A-4 (3)
	B_2	20-40	CL	A-6 (9)
	C	74-86+	SP-SM	A-2-4 (0)
7	A_p	0-9	ML	A-4 (8)
	P_2	13-36	ML	A-6 (8)
8	A_p	0-8	ML	A-4 (8)
	B_1	12-21	ML	A-7-6 (10)
	B_{22x}	25-41	CL	A-7-6 (12)
9	A_p	0-10	ML	A-4 (8)
	B_{21}	15-25	ML	A-4 (8)
	IIB_{23x}	31-50	ML-CL	A-6 (10)
10	B_{21}	14-25	CL	A-7-6 (13)
	B_{24x}	41-61	CL	A-4 (8)

APPENDIX A

SOIL TEST DATA FOR PERRY COUNTY

Site No.	Horizon	Depth in Inches	Grain Size Distribution: Gravel greater than #4 %	Fine Gravel #4-#10 %	Course Sand #10-#40 %	Fine Sand #40-#200 %	Silt #200-0.005mm %	Clay less than 0.005mm %	Liquid Limit %	Plastic Index %	Standard Laboratory Compaction (AASHO T99-57 Method A): O.M.C. %	Max. Dry Weight pcf	Unified Classification	AASHO Classification
1	A_p	0-9	---	---	---	4	58	38	41	16	21	101	ML-CL	A-7-6 (10)
	B_{21}	16-32	---	---	---	10	52	38	37	15	17	107	CL	A-6 (10)
	C	50-60+	---	---	1	13	55	31	34	13	17	107	CL	A-6 (9)
2	A_p	0-9	1	1	0	49	34	15	NP	NP	17	107	SM	A-4 (3)
	B_2	21-36	---	---	---	50	29	21	23	3	15	112	SM	A-4 (3)
	C_1	60-72	---	---	---	58	25	17	NP	NP	15	112	SM	A-4 (1)
3	A_p	0-9	1	0	1	18	78	22	27	4	17	107	ML-CL	A-4 (8)
	B_{22x}	26-46	---	---	3	16	46	35	36	10	17	107	ML-CL	A-4 (8)
	C_1	60-75	---	---	1	7	52	40	40	17	16	110	CL	A-6 (11)
4	A_p	0-8	---	---	1	21	53	25	27	7	17	108	ML-CL	A-4 (8)
	B_{21}	15-28	---	---	---	19	48	33	34	13	15	112	CL	A-6 (9)
	C	50-60+	---	---	---	45	30	25	27	7	15	113	ML-CL	A-4 (4)
5	A_p	0-8	---	1	1	9	66	23	33	7	19	105	ML	A-4 (8)
	B_1	18-32	1	1	3	8	57	30	29	9	19	104	CL	A-4 (8)
	B_{21x}	32-50	---	1	5	7	52	35	33	11	17	108	ML-CL	A-6 (8)
	C_2	74-82+	---	---	4	3	53	40	37	11	18	106	ML-CL	A-6 (8)
6	A_p	0-10	---	---	1	49	40	10	NP	NP	19	103	SM	A-4 (3)
	B_2	20-40	---	---	1	21	48	30	32	13	15	110	CL	A-6 (9)
	C	74-86+	---	---	1	87	3	9	NP	NP	14	105	SP-SM	A-2-4 (0)
7	A_p	0-9	1	0	1	4	75	19	NP	NP	22	99	ML	A-4 (8)
	B_2	13-36	3	1	0	5	57	34	38	10	16	107	ML	A-6 (8)
8	A_p	0-8	---	---	4	6	64	26	33	7	22	100	ML	A-4 (8)
	B_1	12-21	---	---	2	4	58	36	42	14	19	105	ML	A-7-6 (10)
	B_{22x}	25-41	---	---	2	5	53	40	43	21	19	105	CL	A-7-6 (12)
9	A_p	0-10	---	---	1	3	75	21	32	6	22	100	ML	A-4 (8)
	B_{21}	15-25	---	---	1	3	58	38	39	7	18	106	ML	A-4 (8)
	IIB_{23x}	31-50	---	---	1	5	58	36	40	16	18	106	ML-CL	A-6 (10)
10	B_{21}	14-25	---	---	---	5	55	40	43	21	19	104	CL	A-7-6 (13)
	B_{24x}	41-61	---	---	1	19	54	26	26	8	13	116	CL	A-4 (8)

APPENDIX B

I-64 Soil Boring Data in Perry County

The soil test data tabulated below was taken from consultants reports to the Indiana State Highway Commission. Site numbers listed below cprresepond to numbered site locations along I-64 shown on the attached map. Only the sites referred to in the text have test data tabulated. Considerable additional data can be obtained from the consultants reports (12, 13, 14).

Site	Station	Offset (FL)	Depth (FL)	Texture	AASHO Classification	Grain Size Distribution % Sand	% Silt	% Clay	LL.	PI.
11	1553+50	70L "AL"	4.5-6.0	sandy loam	A-2-4 (0)	72	14	14	NP	NP
12	1556+20	42R "A"	0.5-2.0	loam	A-4 (5)	43	38	19	27	7
			7.0-8.0	clay (shaly)	A-6 (8)	10	45	45	37	11
13	1559+00	70L "AL"	0.5-2.0	clay	A-6 (5)	44	25	31	36	12
14	1570+00	42L "AL"	6.0-7.5	clay loam	A-4 (6)	39	34	27	25	8
15	1577+50	42R "A"	14.0-15.0	clay	A-6 (11)	24	45	31	35	17
16	1582+00	42R "A"	22.5-24.0	silty clay	A-7-6 (13)	9	60	31	45	21
17	1603+00	42R "AL"	50.5-51.5	silty clay	A-7-5 (9)	9	57	34	41	11
18	1610+00	42R "A"	15.0-17.5	silty clay	A-6 (10)	9	56	35	34	14
			22.0-23.0	sand	A-1-b (0)	81	13	6	20	2
19	1637+00	42R "A"	0.5-6.0	clay (shaly)	A-6 (11)	27	41	32	40	19
20	1663+00	42R "A"	5.0-6.0	sandy loam	A-6 (4)	51	33	16	33	12

Site	Station	Offset (Ft.)	Depth (Ft.)	Texture	AASHO Classification	Grain Size Distribution % Sand	% Silt	% Clay	LL	PI
21	1669+00	70L "AL"	0.5-4.0	clay (shaly)	A-7-6 (20)	7	39	54	64	40
22	1693+00	42L "AL"	0.5-5.0	silt loam	A-4 (8)	16	65	19	32	10
23	1717+85	25R "A"	6.0-7.5	sand	A-2-6 (0)	82	2	6	32	11
			10.0-11.5	silty clay loam	A-6 (9)	1	74	25	31	12
24	1740+00	70L "AL"	5.0-6.0	silty clay loam	A-4 (8)	20	51	29	37	10
			8.0-9.0	clay (shaly)	A-7-6 (15)	6	39	55	45	24
25	1761+50	42L "AL"	4.0-5.0	sandy loam	A-2-6 (1)	71	21	8	35	16
			10.0-11.5	silty clay loam	A-7-6 (15)	10	62	28	44	25
26	1777+50	42R "A"	15.0-16.5	clay loam	A-4 (6)	39	38	23	23	5
27	1783+00	60R "A"	47.5-49.0	clay (shaly)	A-7-5 (13)	8	43	49	49	19
28	1798+50	42L "A"	15.0-16.5	silt loam	A-7-5 (16)	5	82	13	90	20
			22.5-24.0	silty clay loam	A-6 (9)	1	72	27	40	13
			30.0-31.5	silty clay loam	A-7-6 (10)	5	68	27	43	14
29	1816+00	42L "A"	32.5-34.0	sand	A-2-4 (0)	91	3	6	NP	NP
			37.5-39.0	sandy loam	A-2-4 (0)	77	20	3	NP	NP
30	1850+00	42L "A"	4.0-5.5	sandy loam	A-4 (3)	51	32	17	23	5
			10.0-11.5	sand	A-2-4 (0)	80	14	6	NP	NP
31	1858+00	10L "AL"	14.0-15.5	clay (shaly)	A-7-6 (13)	23	43	34	44	21
32	1893+50	42R "A"	1.0-2.0	silt loam	A-4 (8)	25	56	19	33	9

Site	Station	Offset (Ft.)	Depth (Ft.)	Texture	AASHO Classification	Grain Size Distribution % Sand	% Silt	% Clay	LL.	PI.
33	1905+00	42R " A"	4.0-5.0	clay (shaly)	A-7-6 (20)	5	38	57	58	35
34	1907+50	70R "A"	5.0-5.5	clay	A-6 (7)	38	31	31	31	12
35	1916+00	70R " A"	2.0-3.0	clay	A-7-6 (20)	9	42	49	58	37
			6.0-7.0	silty clay	A-7-5 (14)	2	55	43	55	18
36	1918+25	42L "AL"	0.5-1.0	loam	A-4 (4)	47	41	12	32	9
37	1946+00	42L "AL"	1.0-8.0	silty clay	A-6 (9)	9	60	31	37	13
38	1964+00	70L " A"	0.5-2.0	silty clay	A-6 (9)	7	61	32	36	13
39	1968+00	70L " A"	5.0-6.5	clay (shaly)	A-7-5 (13)	21	32	47	50	17
40	1979+00	℄ " A"	0.5-2.5	sandy loam	A-4 (1)	62	24	14	25	8
41	2016+00	42L "AL"	0.5-3.0	silty clay loam	A-6 (11)	17	57	26	37	16
42	2025+00	42L "AL"	3.0-5.5	clay loam	A-4 (4)	48	31	21	28	7
43	2049+50	70R " A"	10.0-11.5	silty clay	A-6 (9)	10	58	32	37	13
44	2070+50	100L "AL"	0.5-2.0	silty clay	A-7-6 (14)	7	52	41	45	23
			8.0-9.0	clay (shaly)	A-7-6 (19)	7	37	56	56	31
			16.0-17.5	clay (shaly)	A-7-6 (14)	20	31	49	48	21
45	2101+50	100R "A"	9.5-10.0	silty clay	A-6 (10)	5	61	34	35	15
46	2107+00	42R "A"	10.0-11.2	silt loam	A-4 (8)	25	56	19	28	10

APPENDEX C

SOIL CLASSIFICATION AND PROFILE SYMBOLS

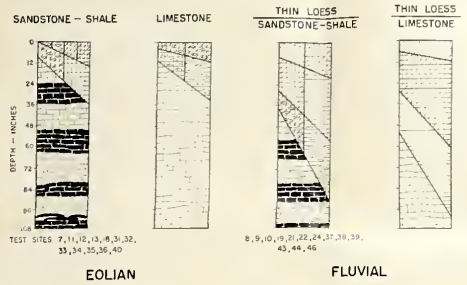
Description	Grain Size Distribution				Plastic Index	Symbol
	Gravel % Retained on #10	Sand #10-#200	Silt 0.05-0.005mm	Clay Less than 0.005mm		
Gravel	85-100	0-15	0-10	0-10	NP	
Sandy Gravel	50-85	15-50	0-10	0-10	6 Max.	
Sand	0-15	85-100	0-10	0-10	NP	
Gravelly Sand	20-49	45-85	0-10	0-10	6 Max.	
Sandy Loam	0-19	50-80	0-50	0-20	6 Max.	
Sandy Clay Loam	0-19	50-80	0-30	20-30	10 Max.	
Sandy Clay	0-19	55-70	0-15	30-45	11 Min.	
Loam	0-19	30-50	30-50	0-20	10 Max.	
Silt Loam	0-19	0-50	50-100	0-20	10 Max.	
Silty Clay Loam	0-19	0-30	70-100	20-30	11 Min.	
Silty Clay	0-19	0-15	55-70	30-45	11 Min.	
Clay Loam	0-19	20-50	50-80	20-30	11 Min.	
Clay	0-19	0-55	0-55	30-100	11 Min.	
Peat or Muck						
Limestone						
Sandstone						
Shale						
Stony Fragments						
Organic Matter						
Topsoil						

Classification of Gravelly Soils

85%-100% gravel plus finer material - Gravel
50%-84% gravel plus finer material - Clayey, silty or sandy gravel
20%-49% gravel plus finer material - Use fine classification and called gravelly sand, gravelly silt or gravelly clay
0%-19% gravel plus finer material - Use fine classification only

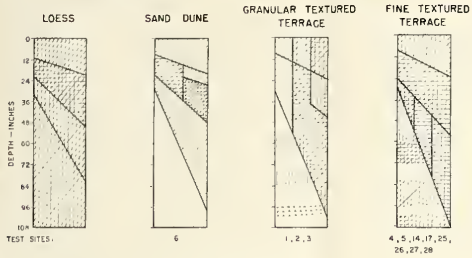
GENERAL SOIL PROFILES

RESIDUAL

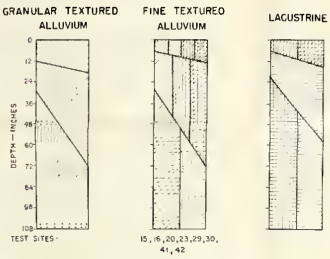


EOLIAN

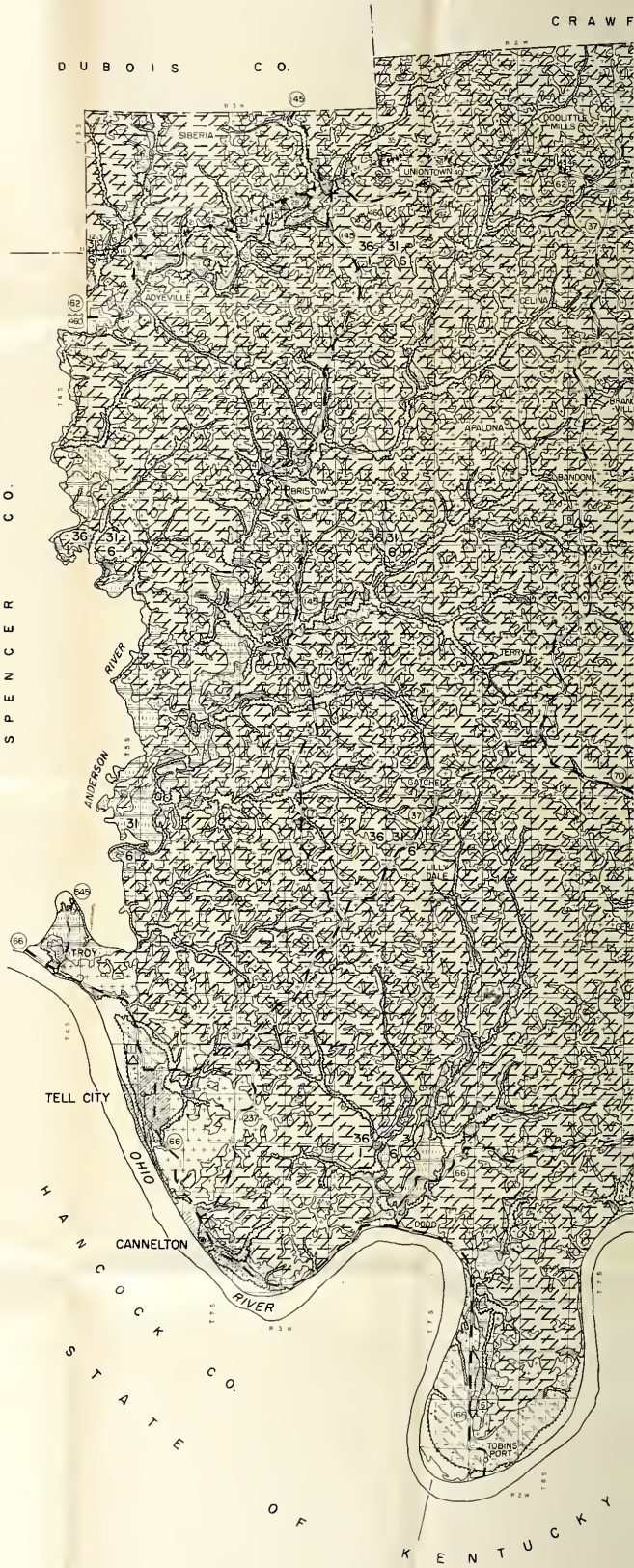
FLUVIAL



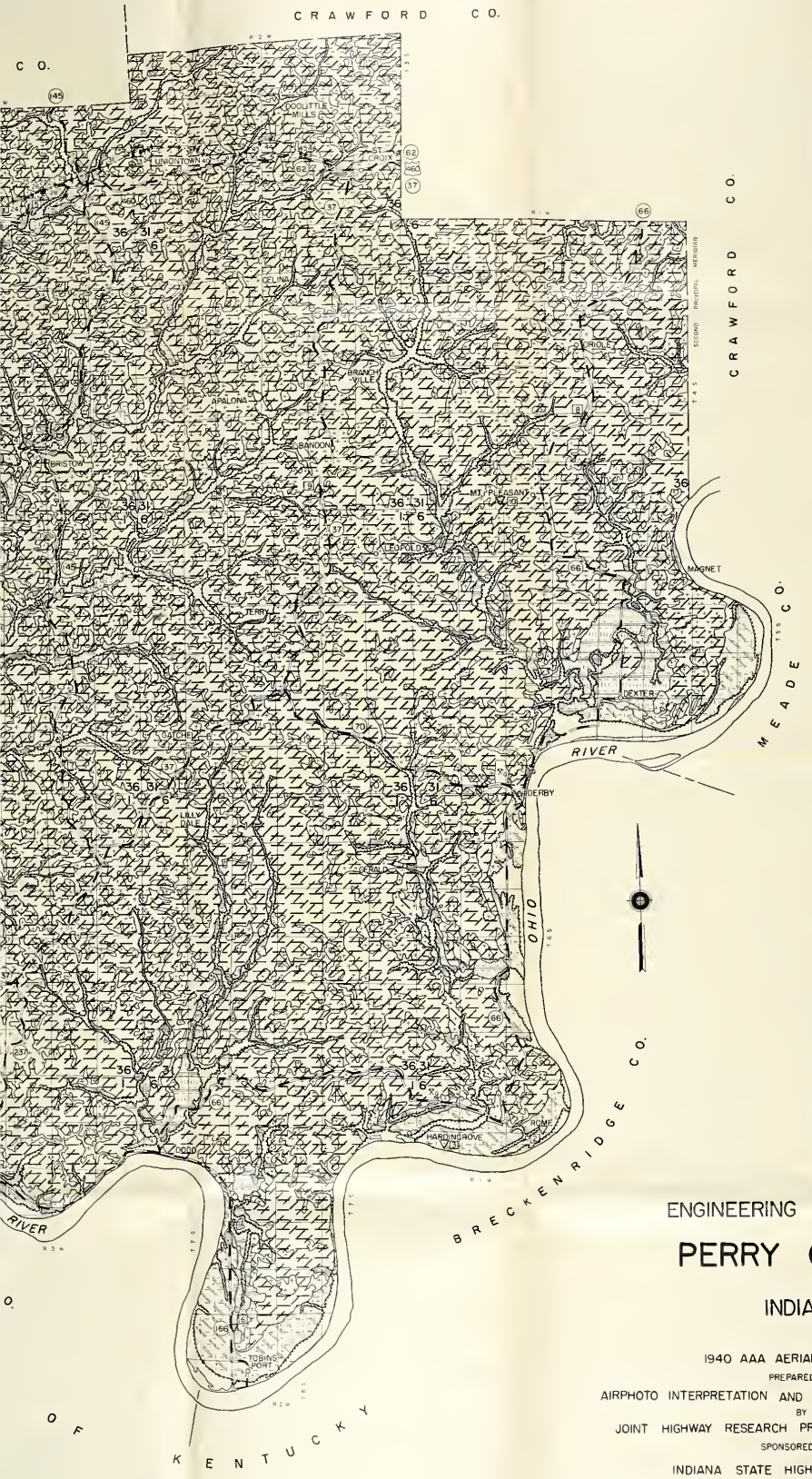
FLUVIAL



TEXTURAL SYMBOLS FOR SOIL PROFILES



PREPARED UNDER THE SUPERVISION OF P. T. YEH



LEGEND

PARENT MATERIALS (GROUPED ACCORDING TO LAND FORM AND ORIGIN)

- LIMESTONE BENCH
- INTERBEDDED SANDSTONE AND SHALE PLATEAU
- THIN LOESS OVER LIMESTONE BENCH
- THIN LOESS OVER INTERBEDDED SANDSTONE AND SHALE PLATEAU
- LOESS PLAIN
- SAND DUNE
- LACUSTRINE PLAIN
- TERRACE
- ALLUVIAL PLAIN

MISCELLANEOUS

- STRIP MINE OR COAL PIT
- LIMESTONE QUARRY
- SOIL SAMPLING SITE
- SOIL SAMPLING SITE (FROM INTERSTATE I-64)

TEXTURAL SYMBOLS (SUPERIMPOSED ON PARENT MATERIAL SYMBOLS TO SHOW RELATIVE COMPOSITION)

- GRAVEL
- SAND
- SILT
- CLAY

ENGINEERING SOILS MAP

PERRY COUNTY

INDIANA

1940 AAA AERIAL PHOTOGRAPHS

PREPARED FROM

AIRPHOTO INTERPRETATION AND PHOTOGRAMMETRY LABORATORY

BY

JOINT HIGHWAY RESEARCH PROJECT, PURDUE UNIVERSITY

SPONSORED BY

INDIANA STATE HIGHWAY COMMISSION

1968

DRAWN BY Y K TANG